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### (54) A method and apparatus for a virtual display/keyboard for a PDA

(57) An improved computer or PDA (100) with a projected display onto a substantially flat, white surface (102, 200) to create a virtual computer screen display (104) and a projected keyboard (108) onto the substantially flat, white surface (102, 200) and a laser sensor (202) projected over the keyboard and parallel to the substantially flat, white surface (102, 200) to create a virtual keyboard (108). The virtual display (104) and virtual keyboard (108) permit the computer or PDA (100) to be substantially smaller than typical computers or PDA's, while also permitting a relatively normal size display and keyboard/user input area.

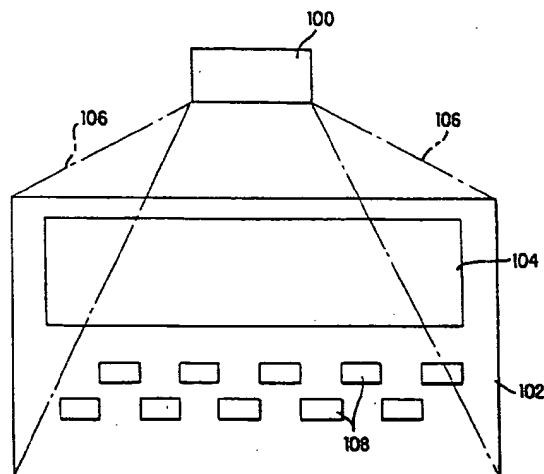


FIG. 1

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**Description**

and sensors for determining finger stroke positioning according to the present invention.

**FIELD OF THE INVENTION**

[0001] The present invention relates generally to the field of personal digital assistants (PDA's) and more particularly to keyboards for PDA's. In particular, this invention provides a space saving virtual display/keyboard for a PDA.

**BACKGROUND OF THE INVENTION**

[0002] Personal digital assistants (PDA's), such as the Apple Newton or the Palm PILOT, have become very useful devices for carrying personal notes, calendars, appointments, phone numbers, 'to do' lists, etc. PDA's are hand held personal computers that help to manage personal information. It would be desirable for PDA's to be as small as possible, such as the size of a credit card, so that they could be carried in a wallet, purse, pocket, brief case, etc. Two of the main limiting factors to the size of PDA's is the requirement for a reasonable quality display and some means for user input, such as a keyboard or area for pen input. To date there has been a tremendous tug-of-war between the desirable small size for portability and the larger size necessary for user input. Accordingly, it would be desirable for a PDA to be relatively small for portability, yet also have a reasonably sized display and user input area.

**SUMMARY OF THE INVENTION**

[0003] The above and other aspects of the present invention are accomplished in a personal digital assistant (PDA) having a virtual display/keyboard. In the PDA according to the present invention, the PDA uses a projection display to create a virtual screen and a projection "finger sensor" to create a virtual keyboard on any flat, light colored surface.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0004] The above and other objects, features and advantages of the present invention will be better understood by reading the following more particular description of the invention, presented in conjunction with the following drawings, wherein:

Figure 1 illustrates a top view of a virtual display/keyboard for a PDA according to the present invention;

Figure 2 illustrates a side view of a virtual display/keyboard for a PDA according to the present invention; and

Figure 3 illustrates a top view of a virtual display/keyboard for a PDA having projection lasers

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

[0005] Figure 1 shows a top view of a PDA 100 projecting a virtual display 104 and a virtual keyboard 108 onto a flat, light colored surface 102. The projection surface 102 would preferably be a substantially white surface, such as a sheet of paper. Also, the virtual keys on the virtual keyboard 108 need not be, but may preferably be in a staggered pattern to allow for laser sensor pick-up, as shown in Figure 2. The projection 106 may be accomplished by means of one of several projection technologies. One example would be the Texas Instruments Digital Micro mirror Display (DMD).

[0006] Figure 2 shows a side view of PDA 100 with projection 106 being emitted from a top edge 208 of the PDA card 100 onto a substantially flat, light colored surface 200, such as a white sheet of paper. Finger sensing of virtual keyboard keys 108 is accomplished by means of laser beams 202 emitted from a bottom edge 204 of PDA card 100 just above the surface of the flat, light colored surface 200. Accordingly, each laser 302 and 306 would sense when a finger or pen 300 had broken the laser beam 202 by sensing the reflection from the finger 300 of the returned laser light to a sensor device 304 and 308, such as a CCD array, see Figure 3. Measuring the laser angle  $\alpha$  and  $\beta$  for each of two lasers 302 and 306 to the finger 300 would identify the exact key location 108. This allows the PDA 100 to sense that the user had "touched" a key 108, either as a keystroke or a pointing action.

[0007] In operation, any data that would normally be displayed on a notebook screen or computer CRT will be projected onto the flat, light colored surface 200 by means of, for example a Digital Micro mirror Display. Also, virtual keys of a keyboard 108 will be projected on to the light colored surface 200 in a staggered fashion, such that when the user touched or points to a particular key, laser sensors 204 at the bottom edge of the PDA card 100 will detect which key is being indicated and the PDA 100 will accept the input as if a key on an actual keyboard had been depressed. Also, as the application of the PDA changes from, for example, a calendar to an address book or to a personal notebook, the functions of the various keys on the virtual keyboard may change to correspond to the associated application of the PDA 100. It should also be noted that the PDA projects a virtual display screen 104 and virtual keyboard 108 that is substantially larger than the area of the PDA. This is how the dual goals of a small PDA size for portability and a large display/user input area is accomplished - by projecting a much larger display/keyboard from a small PDA card.

[0008] The foregoing description of the present invention has been presented for purposes of illustration and

description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and other modifications and variations may be possible in light of the above teachings. For example, the present invention may also be utilized in personal notebooks, personal computers, recreational computer games or in any similar situation where there is a need to conserve the space typically utilized for the computer display and user input/keyboard for the purposes of portability or changing desk top configurations, etc. The embodiment was chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and various modifications as are suited to the particular use contemplated. It is intended that the appended claims be construed to include other alternative embodiments of the invention except insofar as limited by the prior art.

#### Claims

1. A method for creating a virtual display (104) and keyboard (108) for a computer comprising the following steps:
  - (a) said computer projecting a virtual display (104) of data representative of a computer display onto a substantially flat, light colored surface (102, 200);
  - (b) said computer projecting a virtual keyboard pattern of keys (108) onto said substantially flat, light colored surface (102, 200); and
  - (c) said computer embodying remote sensing means (304, 308) for determining which virtual keys are selected.
2. The method according to claim 1, wherein said sensing means (304, 308) for determining which virtual keys are selected comprises the following steps:
  - (1) said computer projecting a laser sensor (202) slightly above and substantially parallel to said substantially flat, light colored surface (102, 200);
  - (2) said laser sensor (202) being projected across said virtual keyboard pattern of keys (108) such that when said laser sensor (202) is intercepted by a finger or other object (300) said computer processes input as if a physical key on a physical keyboard had been selected; and
  - (3) sensing when a virtual key has been selected.
3. The method according to claim 1, wherein said computer is a PDA (100).
4. The method according to claim 2, wherein said substantially flat, light colored surface (102, 200) is white.
5. The method according to claim 2, wherein said substantially flat, light colored surface is a substantially white piece of paper (102, 200).
6. The method according to claim 2, wherein the projecting steps are accomplished by means of a digital micro mirror display (106).
7. A display/keyboard of a computer comprising:
  - a virtual display (104) projected from said computer by means of a digital micro mirror display (106) onto a substantially flat, light colored surface (102, 200);
  - a virtual keyboard (108) projected from said computer by means of a digital micro mirror display (106) onto said substantially flat, light colored surface (102, 200); and
  - two laser sensors (302, 306) projected across said virtual keyboard and substantially parallel to said substantially flat, light colored surface, wherein when said laser sensors (302, 306) are intercepted over a virtual key of said virtual keyboard (108), said computer processes data as if a physical key on a physical keyboard had been selected.
8. The display/keyboard according to claim 6, wherein said computer is a PDA (100).

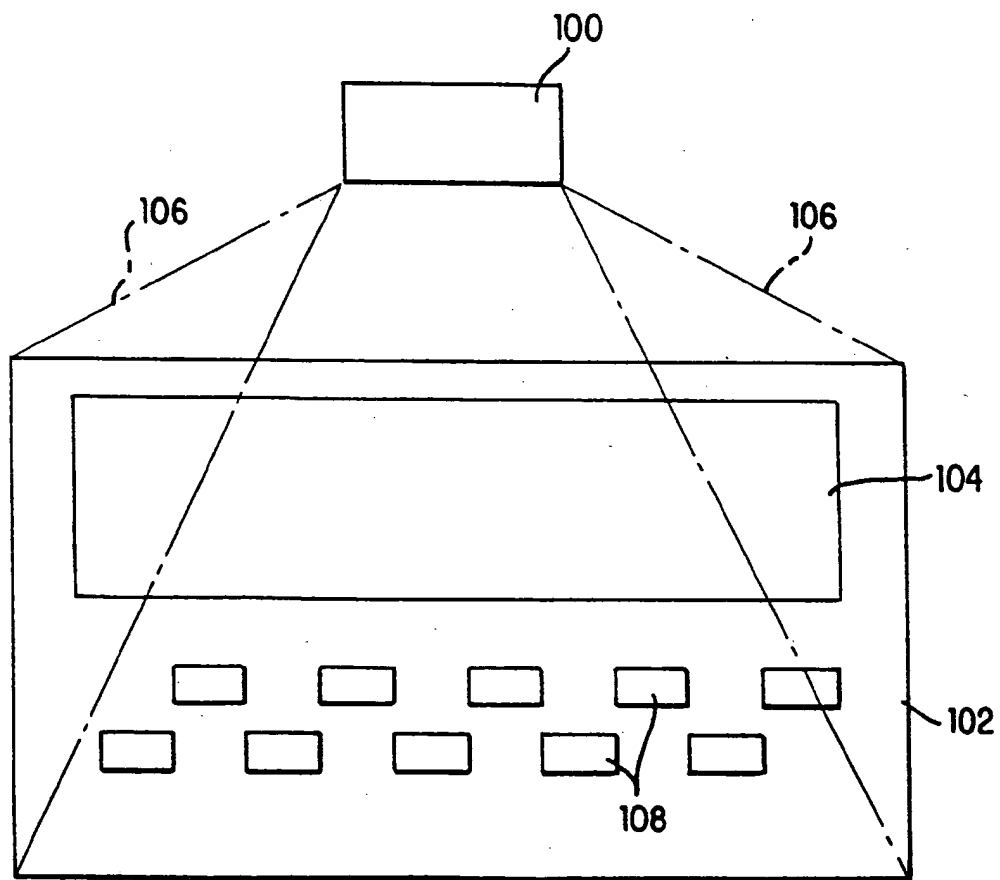


FIG. 1

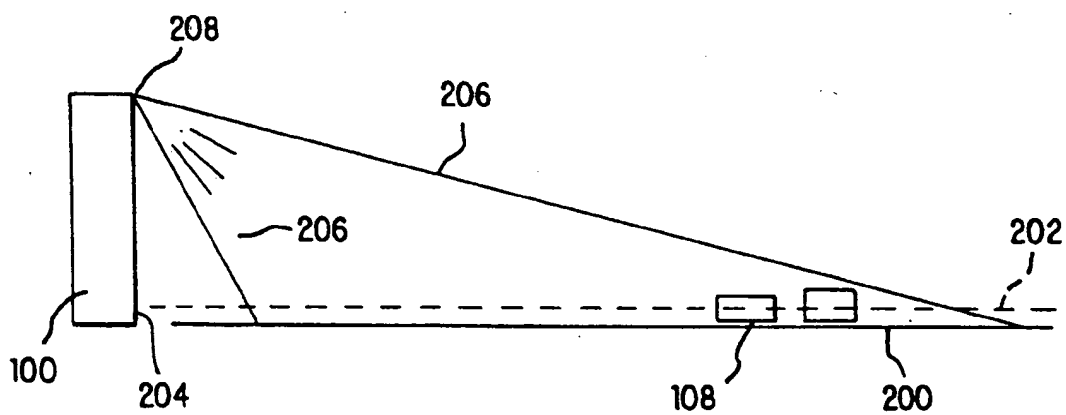


FIG. 2

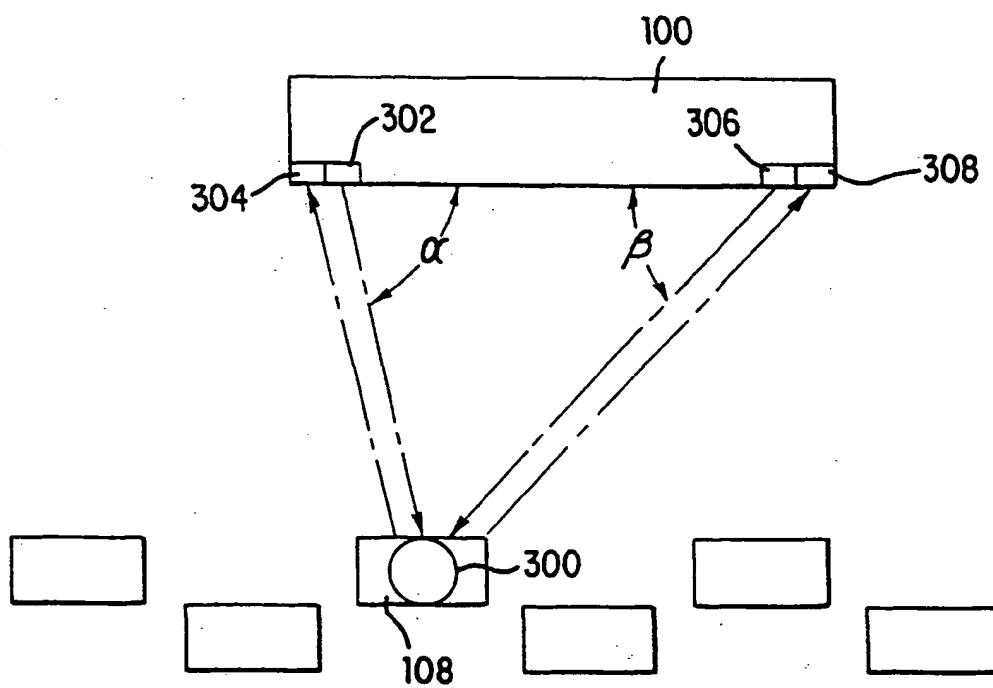


FIG. 3



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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 11 1323

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 789 739 A (SCHWARZ FRANZ) 4 August 1998 (1998-08-04) * column 1, line 56 - column 2, line 50 * * column 3, line 23-36 * * column 4, line 48-56 * * column 5, line 5-32 * * figures 1-3 *	1,2,4,5	G06K11/08 G06F1/16 G06F3/033 G06F3/023
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Y	---	2	
A	---	4,7	
X	DE 298 02 435 U (SIEMENS NIXDORF INF SYST) 7 May 1998 (1998-05-07) * page 1, line 2 - page 2, line 10 * * page 2, line 18 - page 3, line 5 * * figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 November 1999	Examiner Baldan, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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